Feb. 23, 1932. V. M. IMSHENETSKY 1,846,557

PUMP

Filed Dec. 20, 1930 2 Sheets-Sheet 1

Fig. 1.

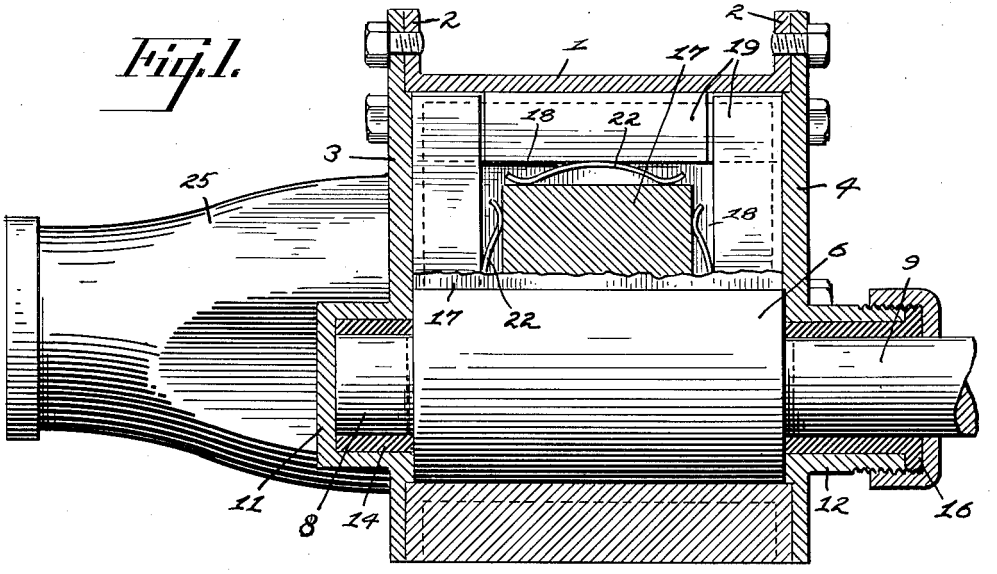

Fig. 2.

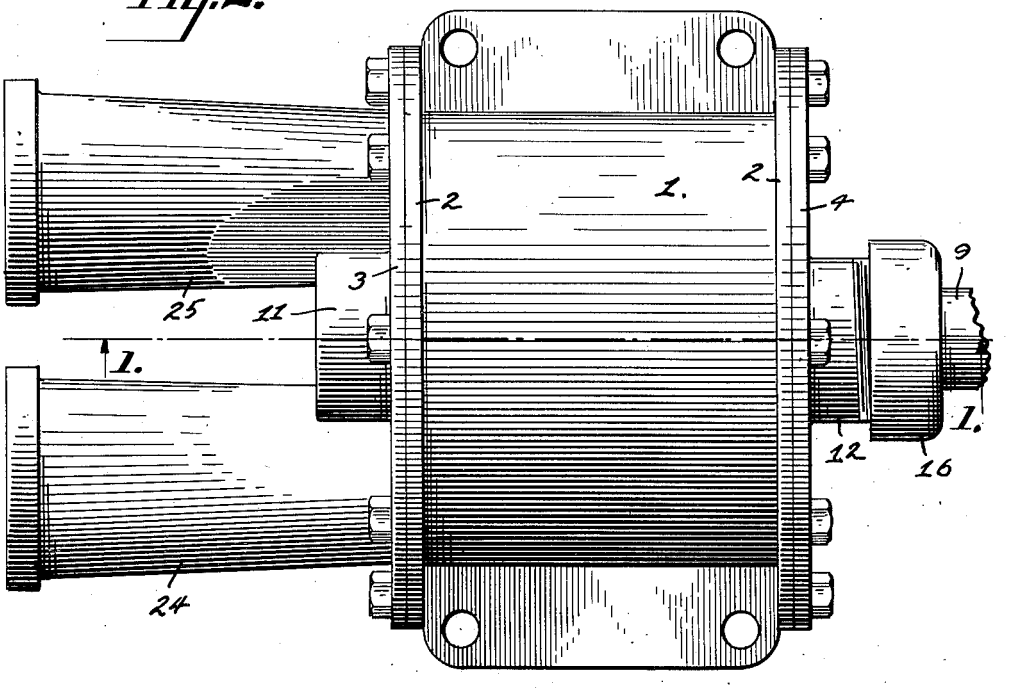

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Fig. 3.

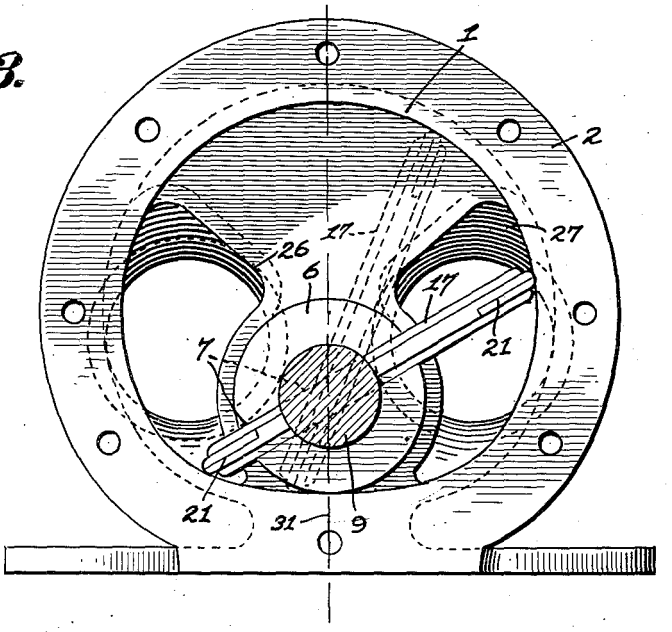


Fig. 6.

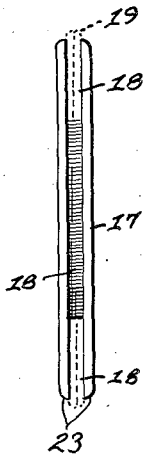


Fig. 4.

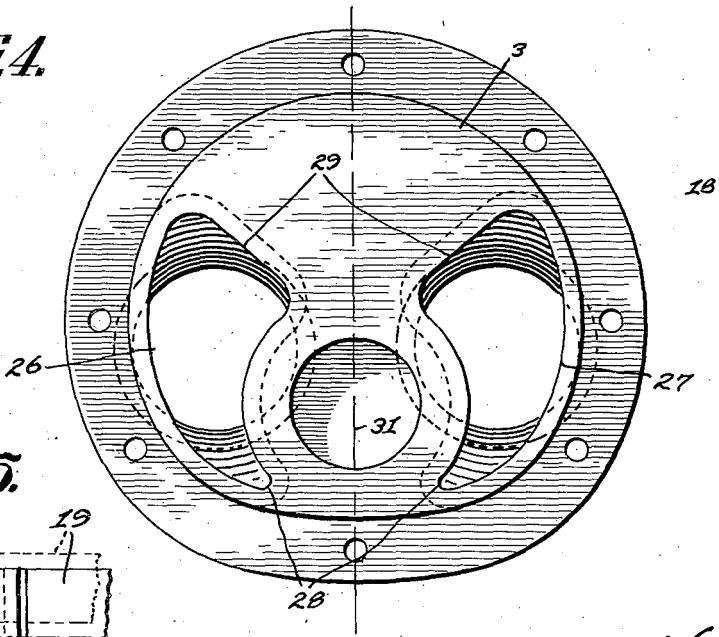
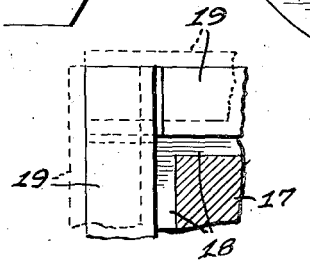


Fig. 5.



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Patented Feb. 23, 1932 1,846,557

UNITED STATES PATENT OFFICE

VLADIMIR M. IMSHENETSKY, OF SAN FRANCISCO, CALIFORNIA

PUMP

Application filed December 20, 1930. Serial No. 503,724.

My invention relates to improvements in rotary pumps wherein a vane, provided with overlapping packing upon its sides and ends, is slidably mounted upon a shaft eccentrically disposed within a cylinder, the inner peripheral wall of which is defined by a complete curve wherein all chords which pass through a point coincident with the axis of the shaft are of the same length, the vane being of a length equal to the length of the curve defining chord and being reciprocated to maintain constant contact at both ends thereof with the peripheral wall of the cylinder when the shaft is rotated and the cylinder being provided with inlet and outlet ports formed in an end wall thereof whereby liquid may be impelled through the pump by a rotation of the shaft and vane within the cylinder.

The primary object of my invention is to provide an improved pump.

Another object is to provide an improved pump of the character described having a vane adapted to obtain a maximum displacement within the pump cylinder.

A further object is to provide an improved pump of the character described wherein the vane is provided with improved packing means to insure uniform contact with the walls of the cylinder and to obtain increased efficiency.

Another object is to provide an improved pump of the character disclosed wherein inlets and outlets are provided in one end wall of the cylinder and shaped to obtain a minimum of frictional loss and a maximum of pumping efficiency.

A still further object is to provide an improved pump embodying improved features of structure and arrangement obtaining economy in manufacture and efficiency in operation.

I accomplish these and other objects by means of the improved device disclosed in the drawings forming a part of the present application wherein like characters of reference are used to designate similar parts throughout the specification and drawings, and in which:—

Fig. 1 is a vertical section of my improved pump, the shaft and part of the vane being shown in elevation;

Fig. 2 is a plan view of my pump;

Fig. 3 is an elevation of the right hand side of the pump, the end plate being removed and the shaft being shown in section;

Fig. 4 is an elevation of the inner side of the rearward cover plate;

Fig. 5 is a broken sectional detail showing the manner in which the packing members overlap at the corners of the vane; and

Fig. 6 is an end elevation of the vane, the packing being indicated in dotted lines.

Referring to the drawings, the numeral 1 is used to designate in general a cylinder-like body provided with annular flanges 2 to which are secured end plates 3 and 4. The inner peripheral wall of the body 1 is not truly cylindrical in form, but is determined by a complete curve characterized by the fact that all chords passing through a point eccentrically disposed within the curve are of equal length. The polar equation of this curve is:

$$R = a\sqrt{1-\cos 2\theta} \pm C$$

A shaft 6 is mounted within the body 1 with its axis coinciding with the projection of the eccentric point from which the cylinder curve is developed. The portion of the shaft 6 which extends between the end plates 3 and 4 is of a diameter such that the periphery of the shaft is disposed in proximate relation and substantially tangent to the inner peripheral wall of the cylinder. A slot 7 is formed diametrically through the shaft to extend longitudinally of the shaft from one end plate to the other.

The shaft 6 is provided with reduced end portions 8 and 9, to engage bearing portions 11 and 12 formed upon the end plates 3 and 4 respectively. The bearing portion 11 consists of a recessed extension projecting outwardly from the plate 3 and closed across its outer end, the end 8 of the shaft projecting into the recess and being journalled in a bushing 14 therein. The end 9 projects outwardly through a suitable packing gland 16 carried by the bearing portion 12, said end

9 being arranged to receive a driving connection of any suitable nature, not shown.

A vane designated in general by the numeral 17 is slidably mounted within the slot 7 of the shaft 6. The vane is of a width substantially equal to the width of the cylinder 1 between the end plates 3 and 4, and is of a length substantially equal to the length of the chord upon which the cylinder curve is developed. The vane extends diametrically through the shaft and is slidably movable therethrough so that as the shaft is rotated, the vane will be reciprocated through the slot 7 with both ends of the vane moving in continuous contact with the inner peripheral wall of the cylinder body 1.

The vane 17 is constructed with grooves 18 formed in the sides and ends thereof. Rigid packing members 19 are mounted within the grooves 18, said members being formed of metal or other suitable rigid material and extending the full length and width of the vane. The ends of the packing members are rabbeted as at 21 so that the ends of each packing member overlap the adjacent ends of the adjacent packing members at the corners of the vane, the overlapping portions of said members combining to obtain a thickness substantially equal to the body portions of the packing members. Springs 22 are mounted within the backs of the grooves 18 to normally press the packing members outwardly from the grooves into firm sliding contact with the adjacent walls of the cylinder body. The ends of the vane 17 are slightly rounded, as at 23, to prevent the vane from binding within the cylinder.

Inlet and outlet connections 24 and 25 are formed upon the end plate 3 upon opposite sides of the bearing portion 11 thereof, said connections opening into the cylinder body 1 through ports 26 and 27 respectively. The ports 26 and 27 are of substantially triangular form and are arranged with vertices 28 extending into the restricted areas between the converging arcs defined upon the end plate by the shaft and cylinder curves at their point of tangency. The triangular ports widen progressively from the vertices 28 to bases 29 which are disposed beyond a medial plane and are inclined at substantially 45° from the common diameter 31, the ports being arranged symmetrically upon opposite sides of said common diameter, and each occupying an area of substantially one fourth of the sectional area of the cylinder. The inlet and outlet connections 24 and 25 are arranged preferably at right angles to the face of the end plate 3, said connections being shaped to partially embrace the bearing extension 11. The outer ends of the connections 24 and 25 are shaped to receive suitable tubular connections, not shown, extending to suitable points of intake and delivery. The cylinder body 1 and shaft 6 are preferably arranged with their common diameter 31 disposed vertically, and with the shaft 6 tangent to the inner peripheral surface of the cylinder at the lowermost point thereof.

In operation, my improved pump, constructed substantially as above described, is connected at any convenient point to intake and delivery connections. As the shaft 6 is rotated by any convenient source of power, the vane 17 is moved to extend alternately from opposite sides of the shaft, both ends of the vane being maintained in constant contact with the walls of the cylinder. Thus, as one end of the vane passes the lowermost point of the cylinder, as indicated in dotted lines in Fig. 3, the vane is displaced diametrically through the shaft by the contact of the opposite end of the vane with the inner peripheral surface of the cylinder, as shown in dotted lines, the displacement of the vane continuing until the then actuating end of the vane reaches the lowermost point.

As the vane is moved upwardly past the inlet port 26, a suction is created within the cylinder whereby liquid is drawn through the intake connection into the cylinder. At the same time, the downward movement of the vane past the outlet port 27 upon the opposite side of the shaft 6 operates to force the liquid out of the cylinder through the outlet port for delivery through the outlet connection 27. The eccentric position of the shaft 6 within the cylinder causes a relatively large area of the vane to be effective for both the intake and delivery of fluid and produces a suction chamber which is relatively large in proportion to the sectional area of the cylinder and to the total area of the vane. As the peripheral speed of points along the vane increases with the distance from the axis of the shaft 6, the outer end of the vane during the most effective portion of the intake movement is moved at a relatively high peripheral speed, thereby obtaining a maximum displacement of a given rate or rotation.

The size and shape of the inlet and outlet ports is such that the vane is rendered effective for substantially the entire revolution, each end being effective from the moment it reaches the vertex of the inlet port 26 upon one side of the shaft until it passes the corresponding vertex of the port 27 upon the opposite side of the shaft. The relatively large size of the ports also serves to reduce the frictional resistance to the flow of liquid through the pump, and thereby obtains an increased efficiency in operation.

The rigid packing members 19 upon the sides and ends of the vane 17 provide an efficient means of preventing leakage past the vane. The packing members 19 at the ends of the vane are moved outwardly to maintain uniform contact with the peripheral wall of the cylinder throughout the rotation of the vane therein. At the same time, the members

19 along the sides of the vane are displaced outwardly to maintain contact with the end walls of the cylinder. The overlapping ends of the members 19 permit the packing to be moved independently along the sides and ends of the cylinder, and in this manner a close fit within the cylinder is maintained regardless of differences in the amount of wear within the pump. The overlapping corners insure a close fit at the corners of the vane and reduce leakage past the vane to a minimum.

The present invention consists in the specific structure and arrangement of parts as herein disclosed together with any modifications thereof which may fall within the scope of the appended claim.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent is:—

A pump comprising a pump cylinder having its inner peripheral wall defined by a complete curve wherein all chords passing through an eccentric point within the curve are of equal length; a shaft mounted within the cylinder with its axis coincident with the eccentric point of the defining curve and with its periphery substantially tangent to the adjacent portion of the cylinder wall, said shaft having a diametrical slot formed therethrough; an end plate secured upon one end of the cylinder and provided with a bearing portion to receive one end of the shaft, said plate having inlet and outlet ports of substantially triangular form upon opposite sides of the shaft, said triangular ports having vertices extending into the restricted areas defined by the converging arc portions of the shaft and cylinder wall adjacent their point of tangency, the ports being symmetrically disposed upon opposite sides of the common diameter of the shaft and cylinder and each occupying an area of substantially one fourth of the sectional area of the cylinder; an end plate secured upon the opposite end of the cylinder and having a bearing portion to receive the shaft; a vane slidably mounted within the shaft slot, said vane being of a length substantially equal to the length of the defining chord of the cylinder curve and being reciprocated through the shaft to maintain continuous contact at both ends thereof with the peripheral wall of the cylinder when the shaft is rotated; and rigid spring actuated packing members mounted within the sides and ends of the vane, said packing members overlapping at the corners of the vane and being movable relatively to each other and to the vane to maintain contact with the peripheral and end walls of the cylinder.

In witness whereof, I hereunto set my signature.

VLADIMIR M. IMSHENETSKY.